Communications of the Association for Information Systems

Volume 47 Article 3

10-11-2020

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Recommended Citation

Paul, J., & Cochran, J. D. (2020). Development and Measurement Validity of a Social Media Activity Instrument. Communications of the Association for Information Systems, 47, pp-pp. https://doi.org/10.17705/1CAIS.04703

Communications of the Association for Information Systems

Research Paper DOI: 10.17705/1CAIS.04703 ISSN: 1529-3181

Development and Measurement Validity of a Social Media Activity Instrument

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Abstract:

The rise in social media and the number of applications and platforms that one can use to engage with others online about social issues such as political discourse, social segregation, and academics has raised valid concerns among researchers. Researchers would benefit from a valid instrument to measure individuals' social media activity in order to thoroughly investigate these profound issues. Accordingly, we design, deploy, and validate a new survey instrument focused on social media activity. We test the model's validity from various perspectives (internal, construct, convergent, etc.) to create a reliable instrument for researchers. The instrument distinctively draws from the theory of planned behavior and social identity theory and, thereby, provides a strong theoretical underpinning to social media activity's dimensions. Our results demonstrate our instrument to have reliability and discriminant validity.

Keywords: Social Media Activity, Survey Instrument, Theory of Planned Behavior, Social Identity Theory.

This manuscript underwent peer review. It was received 03/04/2019 and was with the authors for eight months for two revisions. Kent Marett served as Associate Editor.

1 Introduction

Online social media technologies in conjunction with an increasing number of connected Web devices facilitate information sharing, user-created content, and collaboration between people (Elefant, 2011) and, therefore, have not only changed the way that people communicate with each other but also the way they organize and develop relationships (Beal & Straus, 2008; Derks & Bakker, 2013). Due to social media's global impact, we need to understand how it affects individuals, why individuals use social media, and how they use social media. In this paper, we focus on developing an instrument to measure the latter.

Numerous applications, websites, and tools such as Facebook, Twitter, LinkedIn, Instagram, and WhatsApp allow individuals to share their lives and observe many others with a volume and velocity that has never before been possible. For example, Facebook had more than two billion monthly active users as at 31 December 2017 (Facebook, 2018) and, on average, North American users spend about 6.8 hours a week using Facebook (eMarketer, 2013), which equates to 27 percent of their total time online (Experian, 2013).

Social media plays a profound role in young people's lives. Adolescents heavily rely on social media to build new peer affiliations, manage existing relationships, and stay informed about social activities in their network (Lampe, Ellison, & Steinfield, 2006; Pempek, Yermolayeva, & Calvert, 2009). Researchers have noted that university students use social media when searching for new relationships or maintaining existing friendships (Ellison, Steinfield, & Lampe, 2011; Lampe et al., 2006; Pempek et al., 2009). Social media also impacts young people's learning outcomes, critical thinking (Subrahmanyam & Greenfield, 2008), life transitions, and identity formation (Thomas, Briggs, Hart, & Kerrigan, 2017). For example, researchers have expressed concern about social media's role in creating more intense echo chambers and whether social media enforces particular views at the expense of critical thinking (Aiello et al., 2012; Colleoni, Rozza, & Arvidsson, 2014). Social media activity has implications for an individual's job prospects as well. For instance, as per a survey that Career Builder (2014) released, certain social media behaviors led hiring firms to not consider 51 percent of applicants for a position in 2014. Further, the same survey noted that this percentage has trended upward: it went up to from 34 percent in 2012 to 43 percent in 2013. Researchers have also found media technologies to effectively spread misinformation, conspiracy theories, and pseudoscience (Bessi, Scala, Rossi, Zhang, & Quattrociocchi, 2014; Bessi, Zollo, del Vicario, Scala, Caldarelli, 2015; del Vicario et al., 2016). The World Economic Forum lists massive digital misinformation as a primary threat to global society (Howell, 2013).

Realizing social media's significance and its impact on individuals and society, researchers have focused on understanding its intricacies. Existing measurement instruments favor individuals' perceptions and affect toward social media (for a review of research on psychological needs in a social media context, see Karahanna, Xu, Xu, & Zhang, 2018) rather than their reported use activity. For instance, prior research has focused on needs-affordance-features perspectives (Karahanna, et al., 2018), why users disclose information on social media (Krasnova, Koroleva, Spiekermann, & Hildebrand, 2010), how users meet relatedness needs (Sheldon, Abad, & Hinsch, 2011), and how users accrue social capital using social media (Cheng, Wang, Sigerson, & Chau, 2019). These studies have emphasized topics such as loneliness and connectedness (Sheldon et al. 2011), the cognitive behavioral theory concepts autonomy, relatedness, and competence (Karahanna et al., 2018), and the need to self-disclose (Krasnova et al., 2010). These studies have generally focused on precursors to social media use, such as psychological factors, and have not focused directly on measuring individuals' use activity. With this paper, we extend prior research by designing a valid new survey instrument focused on users' self-reported social media activity. Our instrument, which we ground in the theory of planned behavior and social identity theory, provides a strong theoretical basis to understand user activity in social media. We validate this instrument from various perspectives (internal, construct, convergent, etc.) and, thus, develop a reliable tool that researchers who investigate social media activity can employ in their investigations as a standalone instrument or with other instruments focused on different social media aspects. In our analysis, we use data from students at a large state university.

Since we focus on measurement issues, we followed notable extant literature in this capacity as a guide (Boudreau, Gefen, & Straub, 2001; Goodhue, 1998; Straub, 1989). In particular, we considered: 1) constructs' theoretical meaningfulness, 2) concepts' observational meaningfulness, 3) internal consistency/reliability, 4) convergent, discriminant, and nomological validity.

The paper proceeds as follows: in Section 2, we outline the literature in this area to provide theoretical and observational meaningfulness for social media activity. In Sections 3 to 5, we focus on reliability and

validity concerns about the social media activity instrument. . In Section 6, we discuss our findings and their implications. Finally, in Section 7, we discuss the study's limitations and conclude the paper .

2 Constructs' Theoretical Meaningfulness

The first step in developing an instrument involves achieving conceptual clarity on what one wants to measure (Bagozzi, 1980; Bagozzi & Phillips, 1982). To obtain such clarity, one needs to carefully define constructs that one's measures target at the theoretical level. Since we focus on developing measures of social media activity, we need to explicitly clarify what influences individuals' activity online. We draw from two notable theories in developing our survey instrument and the major dimensions that measure social media activity: social identity theory and the theory of planned behavior. We elaborate on these theories in this section as we establish and clarify these connections. We focus on two pertinent areas: social media users' group identity and individual identity. In essence, we believe that an individual's actions online are influenced by and can be connected back to their group and individual identities.

2.1 Group Identity

As per Hogg and Abrams (1988), we define a social identity as an individual's knowledge that the individual belongs to a social category or group. A social group comprises a set of individuals who hold a common social identification or view themselves as members of the same social category. Hogg and Abrams (1988) posit that two important processes drive social identity formation: self-categorization and social comparison. A social comparison process categorizes persons who are similar to the self as the in-group and those who differ from the self as the out-group. Self-categorization accentuates the perceived similarities between the self and other in-group members and the perceived differences between the self and out-group members. This accentuation occurs for all the attitudes, beliefs and values, affective reactions, behavioral norms, styles of speech, and other properties that researchers believe correlate with the relevant intergroup categorization. As per Hogg and Abrams (1988), the social categories in which individuals place themselves are parts of structured society and exist only in relation to other contrasting categories (e.g., race); along with these identities come perceptions of more or less power, prestige, status, and so on. Further, the social categories precede individuals; individuals are born into an already structured society. Once in society, people derive their identity or sense of self to varying extents from the social categories to which they belong even if they decide to become a counterexample to their societal groups. As such, individuals adopt behaviors and perspectives of the groups with which they identify. When taking on a group's perspectives and behaviors, individuals may also allow the group's perceived perspectives to substitute for their individual critical thinking via groupthink (Esser, 1998). Notably, researchers have theorized some antecedents to groupthink, such as group insulation and homogeneity in members' social background and ideology (Esser & Lindoerfer, 1989). Researchers have commonly associated these characteristics with echo chambers.

Echo chambers represent a growing concern on online social networks (OSNs) because individuals can control their own social network and, thereby, the information they see. While the term echo chamber has become commonplace in the contemporary lexicon, we lack an academic definition for the term even in research that discusses echo chambers. In this paper, we use the Oxford Dictionary's definition: "An environment in which a person encounters only beliefs or opinions that coincide with their own so that their existing views are reinforced and alternative ideas are not considered" ("Echo chamber", 2018). Echo chambers feature emotional gravitation toward shared beliefs and a lack of patience for views that challenge the group norm.

2.2 Individual Identity

In addition to an individual taking on a group's or groups' social identity, individuals to varying degrees also make choices in how they present themselves to others via their choices and actions online. In OSN context, individuals may have varying degrees of interest in idea diversity. In addition to, or in spite of, sharing groups' beliefs, individuals may still seek out analysis and discourse about ideas that counter their own. That is, their identity may be connected to the group, but they may simultaneously present themselves with less or more objectivity in their interactions.

One can connect the theoretical bases for the choices about how an individual behaves online to the theory of planned behavior (TPB) that Ajzen (1991) proposed. As per TPB, an individual's intentions best predict the individual's behavior. In turn, an individual's attitudes about behavior, attitudes about subjective

behavioral norms, and perceptions about their control over their own behavior predict the individual's intentions. The TPB assumes that intentions capture the motivational factors that influence behavior and indicate how hard people will try. As a general rule, the stronger an individual's intention to engage in a behavior, the more likely the individual will perform it. Note, however, that behavioral intention can find expression in behavior only if an individual can decide at will to perform or not perform the behavior. According to TPB, one can directly use perceived behavioral control together with behavioral intention to predict behavioral achievement. Researchers have used the TPB to predict behaviors in many different study settings. For instance, Stone, Jawahar, and Kisamore (2010) examined academic misconduct intentions and behavior using the TPB. In their study, Baker and White (2010) used the TPB to predict adolescents' use of social networking. We believe that the TPB explains an individual's assessment of and/or attitude towards how they engage in OSNs well. If an individual assesses being active on OSNs as beneficial given social norms and behavioral controls, they will likely actively participate in them. On the other hand, they may find little benefit in actively participating in OSNs and chose to primarily observe. As per the TPB, we also expect those constructs to dictate how an individual assesses the benefits of interacting emotionally with or engaging objectively in OSNs.

We note that social identity theory and the TPB overlap on the influence of external social norms. Social norms influence choices that individuals make to behave in particular circumstances, and those social norms may arise from the individual's identification with a particular group and its conventions.

To summarize, we use social identity theory and the theory of planned behavior—two well-known theories from the psychology literature—as a theoretical basis for the instrument we develop. In essence, we believe that an individual's actions online are influenced by and can be connected back to their group and individual identities. However, since we focus on creating an instrument to measure social media activity, we focus on individuals' actual activity.

3 Social Media Activity's Observational Meaningfulness

The second step in instrument development involves using existing theory (when present) as a basis for developing measures. Accordingly, we reviewed the literature to develop dimensions to understand and measure how individuals behave using OSNs. We identified five ways: 1) how an individual interacts with others based on their group identity, 2) how individuals embrace objectivity in their interactions online, 3) the activity level of the individual, 4) whether they are active professionally, and 5) whether they are active socially. Each idea appears to operate independently of the others and are components of social media activity.

Existing instruments related to social media tend to focus on how individuals perceive social media, their affect toward social media, or other psychological considerations (e.g., see Karahanna et al., 2018) rather than assess social media activity specifically. As a result, we constructed new items based on extending the existing theory to develop measures that focus on social media activity. We used the conceptual base from theory to develop items for the five dimensions based on individuals' observed actions. We evaluated and discussed these items with other academic researchers in line with Moore and Benbasat (1991) to determine their face validity and their validity in the social media activity context overall. We also subjected the instrument to confirmatory factor analysis, which we describe in Section 4.

3.1 Group Engagement

Based on social identity theory and social norms from the TPB, we believe that individuals' alignment with groups affects them (either formally or informally) and that the effect manifests in how they interact on OSNs with those group identities in mind. Individuals form groups based on their tendency to organize around others that share common beliefs or traits, and it frequently leads to phenomena such as groupthink and echo chambers. As such, we expect individuals' activity to reflect their group identity in the way that they engage[1] with others online. Accordingly, we developed five items to measure social media group engagement (shortened to group engagement for simplicity) in our instrument (see Table 1).

[1] Agostino and Arnaboldi (2016) support this notion of engagement and different types of social media users as a function of the nature of their engagement.

Table 1. Group Engagement

Item #	Item
G1	I post content that may be controversial on social media as it helps me define myself to others, especially those I believe share my views.
G2	When a social media friend shares an article on social media, I generally "like" it with little consideration.
G3	I send friend requests to "friends of my friends" who I don't know personally if I see they share my beliefs.
G4	I join groups that support my beliefs when I come across somebody who shares and posts views that are contradictory to mine.
G5	I might send friend requests to "friends of my friends" who I don't know personally if I notice that they research matters well before posting.

3.2 Objectivity in Interaction

While individuals may have a group identity based on social identity theory and social norms, we also expect them to embrace or reject objectivity[2] in their activities online. While many individuals online may be subject to groupthink and echo chamber mentalities, it does not preclude someone that shares a group's beliefs or traits from embracing rationality, objectivity, and alternate ideas. In this vein, we expect that individuals who embrace objectivity to consider the sources of the materials they ingest, find more information about topics of interest, and appreciate well-positioned views counter to their own. As such, we developed the seven items to measure an individual's objectivity in interaction (see Table 2).

Table 2. Objectivity

Item #	Item
O1	When I read a shared article on social media, I will often do additional research on the subject.
O2	When I read a shared article on social media, I consider the source of the material.
O3	When I share an article on social media, I consider the source of the material.
O4	I weigh the strength of the argument made over articulation when "liking" articles shared by your friends.
O5	I consider the quality of the source material when "liking" articles shared by my friends.
O6	I share articles on social media that are well-argued or takes a balanced position on the topic.
O7	I share articles that are well researched even if they contradict my existing beliefs.

3.3 Activity Level

Activity level reflects the extent to which individuals interact with others or content on social networking sites. In some cases, individuals interact little with others and may simply absorb material that their "feed" shows them. Others may frequently "like" or comment on others' posts or share information with others. Essentially, the interaction level can range from highly passive to highly active. Much research (e.g., Ellison et al., 2007; Lampe, 2007; Sheldon et al., 2011) supports the extent to which an individual engages with online social networks as a measure of social media activity.

Table 3. Activity Level

Item #	Item
AL1	I spend ___ hours on social media on average each day.
AL2	Much of the time I am on social media is to relax my mind.
AL3	When I am on social media, I will frequently comment on the content or "like" the content.
AL4	How often do you log in to/use social media sites or apps? (Continuously, many times a day, a few times a week, a few times a month, a few times a year, never)
AL5	What percentage of your time on social media is for pleasure? (on a 0 to 100 percent scale)
AL6	What percentage of your time on social media are you engaged and focused on what you are reading? (on a 0 to 100 percent scale)

[2] Karahanna et al. (2018) provide support for the notion of objectivity or lack thereof in interaction in discussing the self-presentation issue (i.e., how individuals present themselves on the social media platform and share information)

3.4 Active Professionally and Active Socially

Individuals may also vary in whether they participate online for professional or social purposes. In other words, an individual might use a social media platform significantly to build, nurture, and maintain professional connections[3] and networks. They might like, follow, and share articles as a way to develop professional relations and create a professional image. Similarly, individuals might use a social media platform significantly to build, nurture, and maintain relationships with friends, family members, and acquaintances, and, therefore, actively like, follow, and share articles posted by these "friends". Other individuals may use it for both purposes, and social identity theory explains how belonging to a professional network rather than a purely social network can dictate one's activity online. In essence, people tend to represent themselves differently depending on the particular social network. As such, we developed the following items to measure active professionally and active socially.

Table 4. Active Professionally

Item #	Item
AP1	I use social media to build professional connections.
AP2	I comment on articles posted by my professional connections on social media.
AP3	I "like" articles that my professional connections have shared through social media.
AP4	I frequently visit social media sites to check on updates about the lives of my professional connections.
AP5	I share articles on social media meant for my professional connections.
AP6	I am careful to post my views on social media because I am not sure what the ramifications may be professionally.

Table 5. Active Socially

Item #	Item
AS1	I use social media to connect with friends and family.
AS2	I frequently visit social media sites to check on updates about the lives of friends/family.
AS3	I share articles on social media meant for my friends/family.
AS4	I "Like" articles that friends have shared with me through social media.
AS5	I comment on articles posted by friends on social media.
AS6	I am careful when I post my views on social media because I am not sure what the consequences may be among my friends/family.

3.5 Constructing the Conceptual Model

We developed our conceptual model for the social media activity instrument based on the idea that fundamental behavioral theories, such as social identity theory and the TPB, guide individuals' actual activity on OSNs. As such, we developed a model that captures individual tendencies to gravitate toward and engage with homogenous groups based on a shared identity and to engage with others with a varying emphasis on objectivity. Essentially, individuals may use social media as a platform to engage with diverse ideas that may conflict with their own, to seek out analyses and objectivity, and to engage in discussions related to the varying perspectives and content that one can find online. These individuals care about facts, evaluate the sources of content, and care about presenting themselves as rational thinkers. On the other hand, they might just be tied to a narrative and gravitate towards a similarly minded group of individuals. Beyond that, we also recognize that individuals may engage with social media to a lesser or greater degree and that that they may participate for professional or social purposes. These factors do not mutually exclude one another and constitute components in an individual's social media activity overall. In Sections 4 and 5, we assess our instrument's validity.

[3] Cheng et al. (2019), Krasnova et al. (2010), and other researchers provide support for using social media to build and maintain relationships.

4 Indicator Reliability and Consistency

In developing a valid instrument, one needs to consider its reliability. Per Nunnally, Durham, Struening, and Guttentag (1975), reliability refers to the extent to which measurements are repeatable. Per Carmines and Zeller (1979), reliability refers to the extent to which measurements are associated with random error. Put differently, reliability measures internal consistency. However, before we delve into analyzing our instrument's reliability, we discuss the data we use for this study and share some relevant details.

To collect data for this paper, we asked participants to fill in a single questionnaire containing items based on the five dimensions we developed. The samples (from an initial study and a replication study) included undergraduate students enrolled at a state university. We collected data using an anonymous survey instrument that we made available to the participants via Qualtrics survey software.

Table 6 summarizes the characteristics of the 441 valid survey responses from the initial study. To further validate the instrument, we conducted a replication study with a new set of participants . We summarizes the characteristic of the 616 valid survey responses from the replication study in Table 6. This important step ensures that one produces an instrument that future research can leverage with confidence. Specifically, we collected and analyzed data from 616 participants on the retained items (i.e., the measurement model; see Figure 2) from the initial study. We present the results from both studies in Section 6.. Both samples represent students at a state university well. For example, students across the two samples were about the same average age as the university as a whole (average age of 23.77 years versus 24 for the university).

Table 6. Characteristics of Sample Data from Initial and Replication Studies

Variable	Initial study	Replication study
Gender	33% males / 67% females	24% males / 76% females
Average Age	23.77 years (8.70 years)	22.78 (7.73 years)
Age range	18-70 years	18-68 years
Marital status	88% never married / 11% married / 1% divorced	87% never married / 10% married / 3% divorced
Average number of work hours	17.85 (13.32 hours)	22.55 (15.37 hours)
Average number of children	0.21 (0.78)	0.18 (0.65)
Average income	$18,350 ($19377.91)	$19,010 ($20,783.16)
Median income	$10,000	$10,000
Race	White 58% / Black 21% / Asian 8% / Hispanic 7% / other 5%	White 50% / Black 26% / Asian 8% / Hispanic 11% / other 5%
Note: we provide the standard deviation for continuous variables in brackets.		

Following the extant literature (Straub, Boudreau, & Gefen, 2004), we used Cronbach's alpha for reliability estimation. Following Hair, Anderson, Tatham, Babin, and Black (2005), we also measured reliability by evaluating how items loaded on each dimension and the square of the total of factor loadings for a dimension.

We did so via confirmatory factor analysis (CFA). As our first step, we performed a confirmatory factor analysis to validate and confirm our conceptual model built using IBM, SPSS AMOS (version 25) software. We present the initial model in Figure 1.

The analysis indicated that several factor loadings did not reach the minimum limit of 0.5 (see Table 7), which indicates weak internal reliability. For example, the factor loading for AP6 (sixth variable for the active professionally dimension) was 0.221. Further, the square of the factor loadings for multiple dimensions did not reach the minimum limit of 0.7 (see Table 8). Finally, our estimation indicated that the Cronbach's alpha for multiple dimensions did not reach 0.7 (see Table 9), which added to the evidence.

In addition to the above, several regression weights were statistically insignificant (p-value > 0.05) and RMSEA and chi-square (Cmin/df) statistics were close to 0.08 and 3, respectively, which indicates a poor fit. We present the fit indices for the initial model in Table 10.

Table 7. Factor Loadings (Initial Model)

Variable		Dimension	Factor Loading	Variable		Dimension	Factor Loading
G1	<---	Group_Engagement	*0.366*	AP4	<---	Active_Professionally	0.723
G2	<---	Group_Engagement	*0.371*	AP5	<---	Active_Professionally	0.71
G3	<---	Group_Engagement	0.81	AP6	<---	Active_Professionally	*0.221*
G4	<---	Group_Engagement	*0.414*	AS1	<---	Active_Socially	0.701
G5	<---	Group_Engagement	0.793	AS2	<---	Active_Socially	0.655
O1	<---	Objectivity	0.542	AS3	<---	Active_Socially	0.568
O2	<---	Objectivity	0.818	AS4	<---	Active_Socially	0.712
O3	<---	Objectivity	0.83	AS5	<---	Active_Socially	0.522
O4	<---	Objectivity	*0.439*	AS6	<---	Active_Socially	*0.243*
O5	<---	Objectivity	0.704	AL1	<---	Activity_Level	0.564
O6	<---	Objectivity	*0.400*	AL2	<---	Activity_Level	0.538
O7	<---	Objectivity	*0.247*	AL3	<---	Activity_Level	0.549
AP1	<---	Active_Professionally	0.695	AL4	<---	Activity_Level	0.712
AP2	<---	Active_Professionally	0.618	AL5	<---	Activity_Level	*0.423*
AP3	<---	Active_Professionally	0.692	AL6	<---	Activity_Level	*0.271*

Table 8. Reliability (Initial Model)

	Group engagement	Objectivity	Activity level	Active professionally	Active socially
Construct reliability	69.85%	79.32%	68.33%	78.90%	74.75%

Table 9. Reliability (Initial Model)

Dimension	Number of questions	Cronbach's alpha
Group engagement	5	0.69
Objectivity	8	0.80
Activity level	6	0.68
Active professionally	6	0.77
Active socially	6	0.73

Table 10. Fit Metrics (Initial Model)

Goodness of fit index	Estimated value
$\chi 2/df$	3.360
RMSEA	0.073
CFI	0.767
GFI	0.806
NFI	0.701
SRMR	0.094

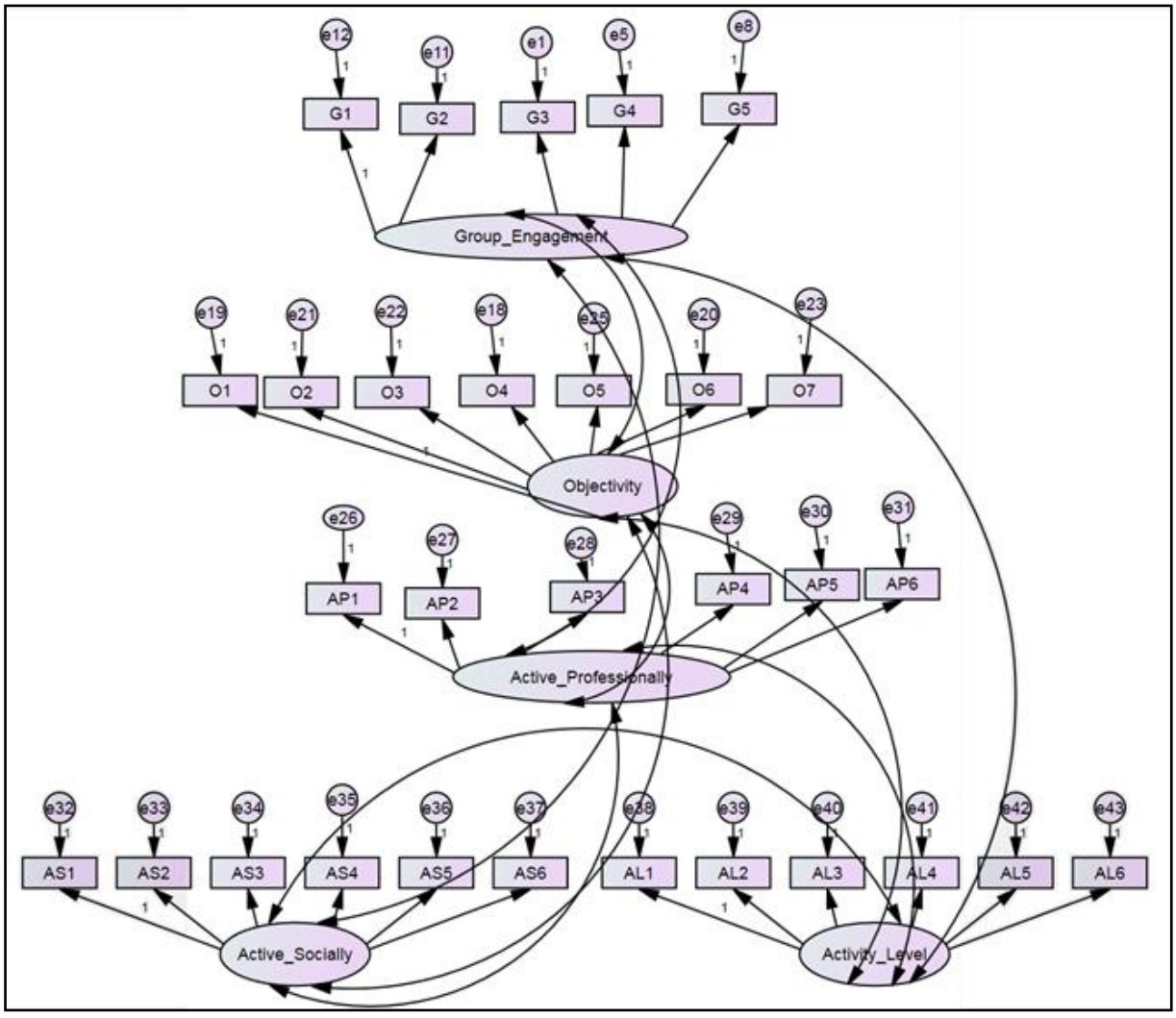

Figure 1. CFA Model (Initial)

To arrive at the measurement model, we deleted variables with low factor loadings one at a time while concurrently measuring the resultant impact to avoid valuable data (variable) loss. We show our final reduced model in Figure 2. With the exception of group engagement and activity level, all dimensions had at least three items and their errors did not correlate with each other. For group engagement and activity level, which had two indicators each, we followed Ridgon (1995) and Kenny, Kashy, and Bolger (1998) to ensure they had no identification issues. One can see the improvement in terms of goodness of fit when comparing Tables 10 (initial model) and 14 (measurement model). From a reliability standpoint, factor loading for each variable in the measurement model exceeded 0.5 (see Table 11), and the square of the total of factor loadings for a dimension exceeded 0.7 (see Table 12), which demonstrates internal consistency. Additionally, the Cronbach's alpha for the measurement items associated with each dimension exceeded 0.7 (see Table 13).

All the fit indices were within acceptable limits. For example, RMSEA was 0.052 (with p-value associated with PCLOSE[4] equal to 0.349) and chi-square statistic (Cmin/df) was 2.173. We list the fit indices in Table 14. To summarize, our model exhibited excellent fit and reliability. We confirmed the dimension validity of newly developed self-reported measures and tested the relationships of the overall instruments for measuring dimensions of social media activity through a replication study that we mention above. Using the retained items from the initial study (see Figure 2), we analyzed the new data that we collected for the

[4] This measure is a one-sided test of the null hypothesis that the RMSEA equals 0.05, which represents a close-fitting model. Such a model is associated with (a not significant) specification error. A p-value greater than 0.05 would indicate that the fit of the model is "close". On the other hand, if the p-value does not reach 0.05, the model's fit would be worse than close fitting.

replication study. All the fit indices for the replication study were within acceptable limits. For example, RMSEA was 0.050 (with p-value associated with PCLOSE equal to 0.808) and chi-square statistic (Cmin/df) was 2.539. We list the fit indices in Table 15. From a reliability standpoint, the factor loading for each variable in the measurement model for the replication study exceeded 0.5 (see Table 16) and the square of the total of factor loadings for a dimension exceeded 0.7 (see Table 17), which demonstrates internal consistency. Additionally, the Cronbach's alpha for the measurement items associated with each dimension exceeded 0.7.

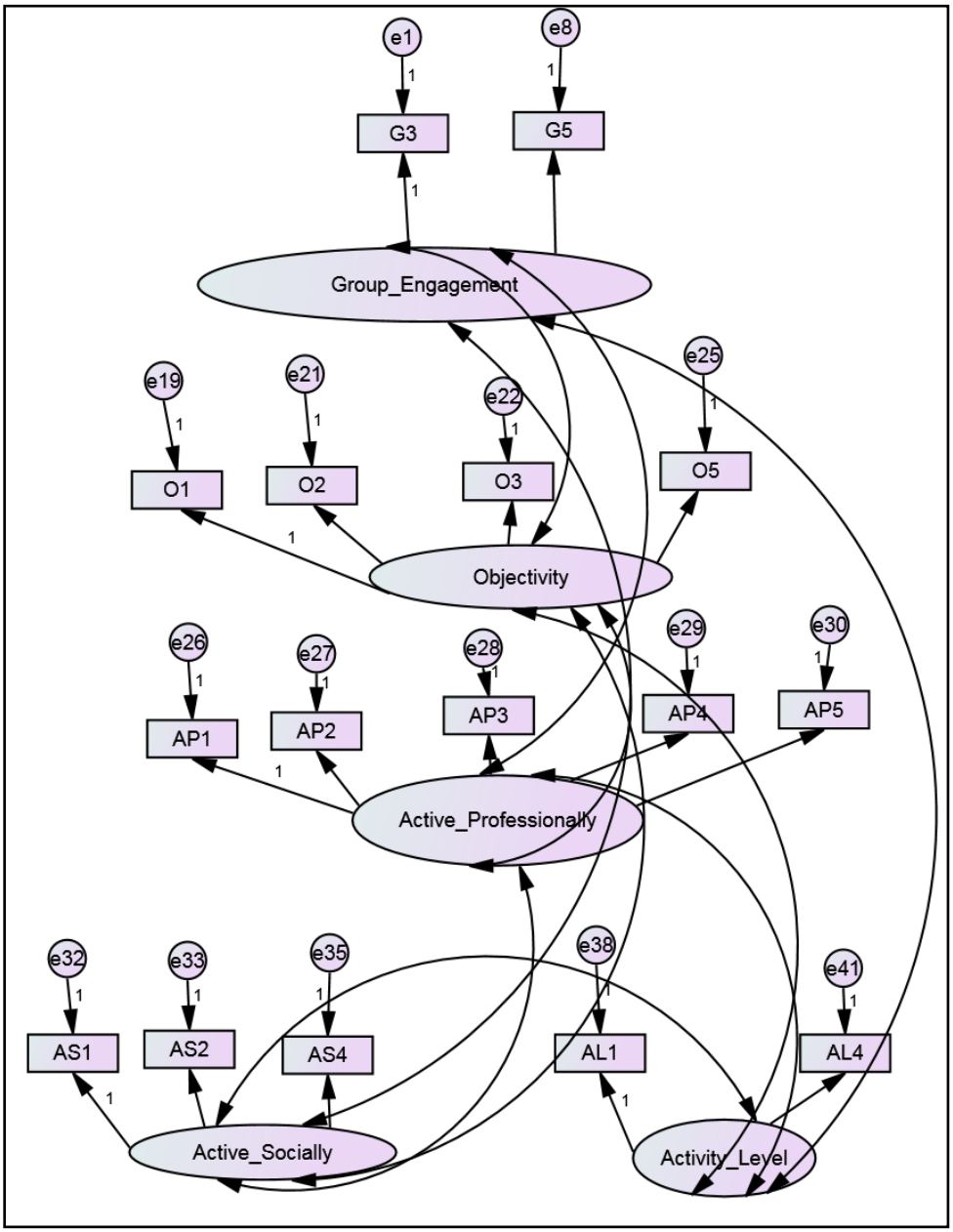

Figure 2. Measurement Model

Table 11. Factor Loadings (Measurement Model)

Variable		Dimension	Factor Loading	Variable		Dimension	Factor Loading
G3	<---	Group_Engagement	0.810	AP1	<---	Active_Professionally	0.699
G5	<---	Group_Engagement	0.827	AP2	<---	Active_Professionally	0.615
O1	<---	Objectivity	0.692	AP3	<---	Active_Professionally	0.682
O2	<---	Objectivity	0.516	AP4	<---	Active_Professionally	0.732
O3	<---	Objectivity	0.831	AP5	<---	Active_Professionally	0.712
O5	<---	Objectivity	0.857	AS1	<---	Active_Socially	0.768
AL1	<---	Activity_Level	0.541	AS2	<---	Active_Socially	0.738
AL4	<---	Activity_Level	0.932	AS4	<---	Active_Socially	0.648

Table 12. Reliability (Measurement Model)

	Group engagement	Objectivity	Activity level	Active professionally	Active socially
Construct reliability	80.25%	82.09%	72.12%	81.84%	76.24%

Table 13. Reliability (Measurement Model)

Dimension	Number of questions	Cronbach's alpha
Group engagement	2	0.80
Objectivity	4	0.81
Activity level	2	0.72
Active professionally	5	0.82
Active socially	3	0.76

Table 14. Fit Metrics (Measurement Model)

Goodness of fit index	Estimated value
$\chi 2/df$	2.173
RMSEA	0.052
CFI	0.953
GFI	0.944
NFI	0.917
SRMR	0.048

Table 15. Fit Metrics (Measurement Model: Replication Study)

Goodness of Fit Index	Estimated Value
$\chi 2/df$	2.539
RMSEA	0.050
CFI	0.948
GFI	0.953
NFI	0.918
SRMR	0.051

Table 16. Factor Loadings (Measurement Model: Replication Study)

Variable		Dimension	Factor loading	Variable		Dimension	Factor loading
AP1	<---	Active_Professionally	0.694	G5	<---	Group_Engagement	0.834
AP2	<---	Active_Professionally	0.647	O1	<---	Objectivity	0.624
AP3	<---	Active_Professionally	0.650	O2	<---	Objectivity	0.769
AP4	<---	Active_Professionally	0.692	O3	<---	Objectivity	0.808
AP5	<---	Active_Professionally	0.718	O5	<---	Objectivity	0.643
AL1	<---	Activity_Level	0.640	AS1	<---	Active_Socially	0.843
AL4	<---	Activity_Level	0.835	AS2	<---	Active_Socially	0.774
G3	<---	Group_Engagement	0.794	AS4	<---	Active_Socially	0.532

Table 17. Reliability (Measurement Model: Replication Study)

	Group engagement	Objectivity	Activity level	Active professionally	Active socially
Construct reliability	79.73%	76.18%	70.89%	81.17%	76.64%

Next, we focused on convergent and discriminant validity for each dimension to see if they differed enough to be useful in research.

5 Convergent, Discriminant, and Nomological Validity

Convergent validity refers to the degree to which multiple attempts to measure the same concepts agree (Bagozzi, Yi, & Phillips, 1991). One can determine convergent validity by looking at the values of the average variance extracted (AVE). We present the convergent validity (variance extracted) results for both the initial study and the replication study in Table 18. As one can see, these results exceeded or came very close to the minimum limit of 0.5.

Table 18. Convergent Validity (Measurement Model)

	Group engagement	Objectivity	Activity level	Active professionally	Active socially
Variance extracted (Initial)	67.03%	54.25%	58.07%	47.49%	51.81%
Variance extracted (replication)	66.30%	51.18%	55.34%	46.34%	53.09%

Discriminant validity refers to the extent to which users respond similarly to different dimensions. One can determine discriminant validity by comparing variance extracted (see Table 18; these values also make up the diagonal of the matrix in Table 19) against the square of the inter-item correlation (see Table 19 for results for the initial study and the replication study). Based on examining Table 19, we can see that all the variance extracted estimates were greater than corresponding squared inter-item correlation estimates, which means the indicators had more in common with the dimension they were associated with than they did with other dimensions. Therefore, our results demonstrate discriminant validity.

Table 19. Discriminant Validity (Reduced Model: Initial Study): Squared Inter Construct Correlation Estimates vs. Variance Extracted[5]

Discriminant validity (reduced model: initial study)					
	Group engagement	Objectivity	Activity level	Active professionally	Active socially
Group engagement	0.67				
Objectivity	0.00	0.54			
Activity level	0.00	0.04	0.58		
Active professionally	0.19	0.04	0.09	0.47	
Active socially	0.00	0.05	0.36	0.19	0.52
Discriminant validity (reduced model: replication study)					
	Group engagement	Objectivity	Activity level	Active professionally	Active socially
Group engagement	0.66				
Objectivity	0.00	0.51			
Activity level	0.00	0.04	0.55		
Active professionally	0.19	0.04	0.09	0.46	
Active socially	0.00	0.05	0.36	0.19	0.53

Nomological validity refers to how extensions to theory fit in the established network of theories (Bagozzi, 1979, 1980). When developing new instruments, one cannot easily determine nomological validity in that an established theoretical base in exactly the same area to connect with does not often exist. However, for this research, we leveraged two theories that predict the ways individuals may behave in terms of their social identity and their evaluation of the benefits and drawbacks to activity in general: social identity theory and the theory of planned behavior. We then extended these established theories and examined individuals' self-reported activity in the OSN context. As such, once validated, our instrument examining what does happen pairs nicely with established theories about what should happen. In addition, it should also pair nicely with existing social media instruments focused on affect or perceptions of OSNs.

Since we used self-reported data, it could contain common method bias from multiple sources such as the content of specific items, scale type, response format, and the general context (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). We performed statistical analyses to assess common method bias's severity. First, we performed a Harmon one-factor test on the conceptually crucial variables in our theoretical model. Results from this test showed that the most covariance explained by one factor was 20.61 percent, which indicates that our results did not contain common method bias. Second, following Podsakoff et al. (2003), we included a common method factor whose indicators included all the principal dimension indicators and calculated each indicator's variances that the method substantively explained. Our results indicate that average method variance was 0.193 and most method variances were not significant. Third, we performed a marker variable test (an extended version of the common latent factor method). For this method, we added another latent factor—physical fitness (see Table 20)—that does not correlate with the other latent factors in the model. We also conducted a subsequent zero constraints test (Archimi, Reynaud, Yasin, & Bhatti, 2018) and found that we could not reject the null hypothesis (i.e., the constrained and unconstrained models were the same or "invariant", p-value > 0.1). This finding demonstrates that any specific response bias does not affect our model. Therefore, we contend that the common method bias does not pose a serious concern for this study. Since the measurement model showed acceptable results, we contend that it represents an acceptable measurement model for social media activity (see Figure 2). We list the final items for each dimension in Table 21.

[5] The results corresponding to the post study data set can be found in Appendix Table A.3.

Table 20. Additional Latent Factor: Marker Variable Test

Dimension	Item
Physical fitness	I try to exercise at least 30 min. a day, 3 days each week. I exercise more than I did three years ago. Exercise helps me succeed in all facets of my life. Good health takes active participation on my part. I spend time each day trying to reduce accumulated stress.

Table 21. Final Measurement Model

Dimension	Item
Group engagement	I send friend requests to "friends of my friends" who I don't know personally if I see they share my beliefs.
	I might send friend requests to "friends of my friends" who I don't know personally if I notice that they research matters well before posting.
Objectivity	When I read a shared article on social media, I will often do additional research on the subject.
	When I read a shared article on social media, I consider the source of the material.
	When I share an article on social media, I consider the source of the material.
	I consider the quality of the source material when “liking” articles shared by my friends.
Active professionally	I use social media to build professional connections.
	I comment on articles posted by my professional connections on social media.
	I “Like” articles that my professional connections have shared through social media.
	I frequently visit social media sites to check on updates about the lives of my professional connections.
	I share articles on social media meant for my professional connections.
Active socially	I use social media to connect with friends and family.
	I frequently visit social media sites to check on updates about the lives of friends/family.
	I “Like” articles that friends have shared with me through social media.
Activity level	I spend ____ hours on social media on average each day.
	How often do you log in to/use social media sites or apps? (Continuously, many times a day, a few times a week, a few times a month, a few times a year, never)

6 Discussion

In this paper, we develop an instrument to help researchers better understand social media activity’s dimensions that can serve as a reliable starting point for analyzing social media activity. The theoretical base for developing this instrument comes primarily from social identity theory and the TPB. In essence, we construct an instrument that connects user activity on OSNs with established theory. This instrument exhibited reliability and discriminant validity between dimensions. We put forth the instrument based on the idea that individuals may behave based on various levels of group identity factors and individual personas in combination with context components (professional or social). Additionally, users may range from inactive to very active in their OSN interactions. Our findings support each factor as a reliable dimension of an instrument for overall social media activity.

The impact of group engagement in the realm of OSNs emerged as a particularly important area for consideration. While some once perceived the Internet as an environment where truth would prevail and deceit and misleading information would be quickly and easily debunked, this belief has seriously come into question in recent years. In particular, the items retained from the group engagement dimension (G3 and G5) highlight the considerations that individuals make when considering growing their social network via “friends of friends”. They will likely grow their social network by adding individuals with similar views and if they believe that their “friends” research matters well before posting.

The objectivity dimension indicates how additional research about topics and how individuals evaluate content's source load together in the instrument. The items we retained in the survey indicate the importance of reliable sources on social media. Individuals developing a persona as objective thinkers on social media will tend to position themselves as well informed and will not accept information at first glance, while other individuals will neither do additional research or consider sources in using OSNs. As we mention in Section 1X, sources' reliability has become one of the most critical issues surrounding social media. Indeed, the World Economic Forum has identified the risks of massive digital misinformation as a major concern to global society (Howell, 2013). In recent elections, certain actors deployed social media bots in attempts to influence national elections in France, Germany, and the United States by spreading misinformation. By one estimate, up to 15 percent of Twitter profiles are bots (up to 50 million) (Kupferschmidt, 2017).

Regarding the activity level dimension, we found the best items to understand activity level relied on the number of hours individuals spend each day on social media. Similarly, we found numerous items loaded together in both the professional use and social use contexts. As a point of reference, Statista found that daily time spent on social networking worldwide increased from 90 minutes per day in 2012 to 135 minutes per day in 2017 (Statista, 2017). Our data collected from students at a large state university in 2017 indicates that, on average, individuals in our sample spent about 158 minutes on social media per day, which compares favorably with the Statista data.

Understanding individuals' actions on OSNs has attracted considerable national and international concern as analysts consider to what extent social media affects presidential elections, revolutions against governments in various nations, the proliferation of "fake news", and the impact that OSNs have on individual characteristics such as entitlement, narcissism, and critical thinking. In this way, this instrument can assist researchers in investigating the impact that social media activity has on numerous outcome variables of interest such as critical thinking, groupthink and echo chambers, and societal changes in attitudes and beliefs.

From an academic research standpoint, our study extends the relevance of social identity theory and the TPB in studying and evaluating human activity to social media activity. A valid instrument that records individuals' self-reported social media activity will further enhance research as researchers connect it with other instruments that study psychological or societal topics at the individual level.

At the organizational level, social media has become a primary tool for communication, promotion, retention, and penetration (Hanna, Rohm, & Crittenden, 2011; McCaughey, Baumgardner, Gaudes, Larochelle, Wu, & Raichura, 2014: Khan, Hoffman, & Misztur, 2014). Organizations adopt social media for various purposes. For example, in April, 2013, the USA Securities and Exchange Commission issued a report that permitted companies to "use social media outlets like Facebook and Twitter to announce key information in compliance with Regulation Fair Disclosure" (SEC, 2013). Our validated instrument provides a way for organizations to measure customer and employee social media activity and use our results as guidance for key policy decisions.

In the public sector setting, Severo, Feredj, and Romele (2016) suggest that social media data can provide faster and more accurate insights that can help policymakers improve decision making. In a related vein, Kagarise and Zavattaro (2017) highlight the value of citizen engagement with municipal social media content and its influence on public policymaking. Schober, Gerrish, and McDonnell (2016) echo this sentiment. Our instrument could be useful to public sector officials in studying if social media interactions with government can improve communication outcomes with their citizens (Isett & Hicks, 2018).

7 Limitations and Future Directions

We believe our instrument makes a valuable link between fundamental theories that explain what influences individuals' activity and their actual activity in a social media context. Additionally, the instrument demonstrates reliability and discriminates between dimensions relevant to social media activity. As a result, we believe this instrument will be a valuable addition to researchers further exploring how social media activity to their dependent variables of interest. We also expect the instrument to be valuable in various contexts, such as information systems, education, business, sociology, and psychology.

Yet, the instrument has limitations that open doors for future research. We expect that our instrument has more relevance in the contexts such as Facebook, Twitter, and LinkedIn primarily because they serve as vehicles for broad ideas and relaying news much more than other social networks such as Foursquare, Instagram, and Snapchat. Additionally, while our sample represents individuals who make up a major component of social network user population overall, it notably neglects young users (< 18 years old) and older users (> 50 years old). Different considerations may drive their activity on OSNs.

Additionally, we are not satisfied with the limited range of the group engagement items from our instrument and encourage other researchers who use this instrument to consider testing some additional items in their research to extend the construct validity of group engagement. Future directions would involve pairing the instrument with various outcome variables of interest. We focused mainly on student data. It would be interesting to assess results when using data from organizations. In particular, it would be interesting to compare results or predictive power when dealing with organizations that discourage social media involvement versus organizations indifferent to it.

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Appendix: Social Media Activity Questionnaire

We used the following scale for the questionnaire: disagree strongly (1), disagree moderately (2), disagree a little (3), neither agree nor disagree (4), agree a little (5), agree moderately (6), agree strongly (7).

Group Engagement

G1: Trolling people on social media that don't agree with my views gives me satisfaction.

G2: When a social media friend shares an article on social media, I generally "like" it with little consideration.

G3: I send friend requests to "friends of my friends" who I don't know personally if I see they share my beliefs.

G4: I join groups that support my beliefs when I come across somebody who shares and posts views that are contradictory to mine.

G5: I might send friend requests to "friends of my friends" who I don't know personally if I notice that they research matters well before posting.

Objectivity

O1: When I read a shared article on social media, I will often do additional research on the subject.

O2: When I read a shared article on social media, I consider the source of the material.

O3: When I share an article on social media, I consider the source of the material.

O4: I weigh the strength of the argument made over articulation when "liking" articles shared by your friends.

O5: I consider the quality of the source material when "liking" articles shared by my friends.

O6: I share articles on social media that are well-argued or takes a balanced position on the topic.

O7: I share articles that are well researched even if they contradict my existing beliefs.

Active Professionally

AP1: I use social media to build professional connections.

AP2: I comment on articles posted by my professional connections on social media.

AP3: I "like" articles that my professional connections have shared through social media.

AP4: I frequently visit social media sites to check on updates about the lives of my professional connections.

AP5: I share articles on social media meant for my professional connections.

AP6: I am careful to post my views on social media because I am not sure what the ramifications may be professionally.

Active Socially

AS1: I use social media to connect with friends and family.

AS2: I frequently visit social media sites to check on updates about the lives of friends/family.

AS3: I share articles on social media meant for my friends/family.

AS4: I "like" articles that friends have shared with me through social media.

AS5: I comment on articles posted by friends on social media.

AS6: I am careful when I post my views on social media because I am not sure what the consequences may be among my friends/family.

Activity Level

AL1: I spend ____ hours on social media on average each day.

AL2: Much of the time I am on social media is to relax my mind.

AL3: When I am on social media, I will frequently comment on the content or “like” the content.

AL4: How often do you login to/use social media sites or apps? (Continuously, many times a day, a few times a week, a few times a month, a few times a year, never.)

AL5: What percentage of your time on social media is for pleasure? (On a 0 to 100 percent scale.)

AL6: What percentage of your time on social media are you engaged and focused on what you are reading? (On a 0 to 100 percent scale.)

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